# PROPERTIES OF CEMENT SAND BRICK CONTAINING FLY ASH AS PARTIAL CEMENT REPLACEMENT

NOREZZATY BTAHMAD NADZRI

B. ENG(HONS.) CIVIL ENGINEERING

UNIVERSITI MALAYSIA PAHANG

## SUPERVISOR'S DECLARATION

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the Bachelor Degree of Civil Engineering

_____

(Supervisor's Signature)

Full Name :ASSOC. PROF. DR. KHAIRUNISA BT MUTHUSAMY

Position :SUPERVISOR

Date : JANUARY 2019

## STUDENT'S DECLARATION

I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

_____

(Student's Signature)

Full Name : NOREZZATY BT AHMAD NADZRI

ID Number : AA15268

Date : JANUARY 2019

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NOREZZATY BT AHMAD NADZRI

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## ABSTRACT

Fly ash can be found in large quantities because our country has several power plant stations. The waste disposal of fly ash effects to the environment surroundings. The cement production also causes air pollution, water pollution, and others. By using fly ash as an alternative construction material is a right step to preserve the environment. Hence, this study conducted to investigate the properties of cement sand brick containing fly ash as partial cement replacement. There are several tests conducted to investigate the effect of fly ash as partial cement replacement on compressive strength, flexural strength, and water absorption of cement sand brick. The test of brick specimens with replacement ratios of 0%, 10%, 20%, 30% and 40%, are measured and are compared with those of the bricks specimens without fly ash at the same ages. The water absorption measured at 28 days after the bricks undergo water curing. The type of curing used in the experiment is water curing in aged of 7 and 28 days. All experimented works are follow the standard of ASTM. Furthermore, the observation of strength behaviors are analyzed and discussing in terms of the properties of cement sand brick. In term of compressive strength, the higher the percentages of fly ash used, the lower the compressive strength of brick. With regard to flexural strength, the higher the percentages of fly ash, the lower the flexural strength of brick. Based on water absorption, the higher the percentages of fly ash, the higher the water absorption. Conclusively, the brick contain fly ash can be used for non-load bearing application.

# ABSTRAK

Abu-abu terbang boleh ditemui dalam kuantiti yang besar kerana negara kita mempunyai beberapa stesen janakuasa. Pelupusan sisa abu terbang memberi kesan kepada persekitaran. Pengeluaran simen juga menyebabkan pencemaran udara, pencemaran air, perubahan klimaks dan lain-lain. Dengan menggunakan abu terbang sebagai bahan binaan alternatif adalah langkah yang tepat untuk memelihara alam sekitar. Oleh itu, kajian ini dijalankan untuk mengkaji sifat-sifat bata pasir simen yang mengandungi abu terbang sebagai pengganti kepada simen. Terdapat beberapa ujian dijalankan untuk menyiasat kesan abu terbang sebagai pengganti simen pada kekuatan mampatan, kekuatan lenturan, dan penyerapan air Ujian spesimen bata dengan nisbah gantian sebanyak 0%, 10%, 20%, 30% dan 40%, dan umur 7 dan 28 hari diukur dan dibandingkan dengan spesimen batu bata tanpa abu terbang pada umur yang sama . Jenis pengawetan yang digunakan dalam eksperimen ialah pengawetan air. Semua eksperimen mengikuti standard ASTM. Tambahan pula, kelakuan kekuatan pemerhatian dianalisis dan dibincangkan dari segi sifat-sifat bata pasir simen. Penyerapan air adalah28 hari selepas batu bata menjalani pengawetan air. Dari segi kekuatan mampatan,semakin tinggi persentase abu terbang yang digunakan, semakin rendah kekuatan mampatan bata. Berkenaan dengan kekuatan lenturan, semakin tinggi peratusan abu terbang semakin rendah kekuatan lenturan bata. Berdasarkan penyerapan air, semakin tinggi peratusan abu terbang, semakin tinggi penyerapan air. Walau bagaimanapun, bata mengandungi abu terbang yang boleh digunakan untuk aplikasi tanpa galas.

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# CHAPTER 1

# INTRODUCTION

## 1.1 Introduction

**N**owadays, the environmental management and construction industry are of great importance. The main factor of this problem here is waste production. Waste is the biggest treat to environment and it will give a negative impact in our future. So, we have to manage it wisely. Waste can be produce in many sources for example from coal power plant industry. Malaysia have many place that generate coal power plant for electricity. From that industry it produces about million tons of waste that called fly ash.

Fly ash is one of the waste product from the coal combustion process with temperature reach approximately 2800°F. Fly ash is a fine grained materials consisting mostly of spherical, glassy particles. Fly ash can be found in large quantities and small commercial value in Malaysia. Hence, the waste products have a potential to be used in construction industry. The suggestion is to use the fly ash as cement replacement. Cement is the main product that has high demand in construction industry in Malaysia. By using fly ash as a potential cement replacement it will might give a benefit for our construction industry. In addition, the price of fly ash is more effective compared to the price of cement.

## 1.2 Problem Statement

Awareness of environmental problem due to waste disposal and high demand of construction material like natural sand and cement are needed so that construction industry find and accept partial material replacement especially from recycle material or waste material. Fly ash will also affect the environment surrounding. From the combustion of coal, it will causes bad pollution to the environment. For example it will causes of air pollution. Human can easily having a disease from the low quality of environment. In addition, using a waste material in construction industry is one of the right ways to ensure that waste material been manage correctly and it does reduce the area to dispose waste material. Fly ash is one of the waste material that is available in Malaysia. There are six coal power electricity plant station for long time being for example in Manjung power station, Perak. Normally, the growth in power plant that use coal as the source of fuel has produced a million tons of ash every day (Abdullah, 2016). With amount of coal industry are expected to increase in the future, using fly ash as an alternative construction material is a right step to preserve the environment.

Production of cement can cause soil erosion, air pollution, water pollution, urban heat and flooding (Banthia, 2014). It is because factory that produce cement will release carbon dioxide gases. The carbon dioxide gases will effect to the environment and also human health. Noise emissions occur throughout the whole cement manufacturing process from preparing and processing raw materials, from the clinker burning and cement production process, from material storage as well as from the dispatch and shipping of the final products. The heavy machinery and large fans used in various parts of the cement manufacturing process can give rise to noise and/or vibration emissions. Reducing the number of cement used is also one of the ways to preserve the environment since cement is obtaining from the factory. Thus, study on uses of fly ash as an alternative sand in brick industry with a view of effective utilization of the resources and environmental protection is necessary.

## 1.3 Objective

This research is conducted to achieve the following objective:

i. To investigate the effect of fly ash as partial cement replacement on compressive strength of cement sand brick.
ii. To investigate the effect of fly ash as partial cement replacement on flexural strength of cement sand brick.
iii. To investigate the effect of fly ash as partial cement replacement on water absorption of cement sand brick.

## 1.4 SIGNIFICANT OF STUDY

This study enlighten the society about the use of waste materials for brick production. The study will give a further information about using fly ash as partial sand replacement in the production of cement sand bricks. This work will contribute to green technology development in Malaysia. Succeeding in this research will decrease the number of cement production activity thus as the same time preserved the environment. The information is expected to contribute to better understanding about the behaviour of the brick contain fly ash that acts as a partial cement replacement.

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